



## Wisconsin Department of Transportation

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**DATE:** February 21, 2008

**TO:** Consultants and Contractor's Working for WisDOT

**From:** Steven W. Krebs, PE  
Chief Materials Management Engineer  
Bureau Of Technical Services - DTSD

**SUBJECT:** **Nuclear Gauge Policy for Operation on WisDOT Projects**  
**Acceptance and QMP Density Testing**  
(Supersedes July 23<sup>rd</sup>, 2007)

In the year 2008 construction season, all nuclear density testing for improvement projects and all acceptance testing and sampling must be by certified technicians. Certified samplers and testers is a FHWA requirement of CFR 23 part 637. Only the University of Wisconsin Platteville as part of the Highway Technician Certification Program (HTCP) offers the nucdensity tec-1 class.

Attached you will find policy information for the operation of all nuclear gauges on WisDOT administered projects, including WisDOT, consultant and contractor gauges. WisDOT has established a list of consultants and contractors approved to perform nuclear testing on WisDOT administered projects. Consultants and contractors must be on this list in order to perform nuclear density testing on WisDOT projects for the 2008 season. This list is established and will be maintained by the Quality Assurance Unit in the Bureau of Technical Services and will be accessible to all WisDOT Regions. This information is available on the WisDOT Materials Tracking web site at [www.atwoodsystems.com/materials/.com](http://www.atwoodsystems.com/materials/.com). **To verify that we have the correct information for your company, we are asking that you submit the following information yearly:**

1. Current copy of your Wisconsin Agreement State License or Your Federal Nuclear Regulatory Commission (NRC) license.
2. Copies of current **3 block calibration certificates** or 5 blocks for other states conducted by manufacturer or approved calibration service.
3. Copy of current calibration of company's radiation survey meter.
4. Company contact person, RSO or Safety Officer, (please update as changes occur).
5. E-mail address if applicable

Please send this information to: Wisconsin Department of Transportation  
Bureau of Technical Services. Truax Center  
ATTN: Robert L. Schiro  
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Please contact the region Materials Section if you have any questions regarding this information. If further assistance is needed, contact Robert L. Schiro, WisDOT Radiation Safety Officer, at (608) 243-5998 Office (608) 516-6359 Cellular.

## **OPERATION OF NUCLEAR GAUGES ON WisDOT PROJECTS**

To comply with DHFS and Federal regulations, protect the safety of operators and the public, and maintain acceptable accuracy of measurement, all gauge operators shall be required to comply with all DHFS and WisDOT directives, rules and policies pertaining to nuclear testing operations. Such compliance shall include, but not be limited to, the following items:

1. When an accident including a lost or stolen gauge, stuck source, damaged gauge or a gauge involved in a vehicle accident occurs, follow your emergency procedures including contacting the Radiation Safety Officer.
2. All accidents involving nuclear density gauges must be reported to the WisDOT RSO at (608) 243-5998 (work) or (608) 516-6359 (cell) and DHFS at (608) 267-4797, during daytime hours or the 24 emergency numbers at (608) 258-0099. When using the 24-hour emergency number indicate this is a “radiological incident.”
3. For the reporting requirements see HFS 157.13(17)(b) 2 and HFS 157.32(1).
4. Authorized User Training shall satisfy your license requirements.
5. Operators shall have a current leak test certificate for all gauges used on the project.
6. Transportation of gauges shall be in an approved, properly labeled and locked transport Type “A” case. A shipper Declaration of Dangerous Goods or a bill of lading shall be properly displayed. When the gauge is not directly under direct supervision, the gauge must be locked in it’s transport case and protected by two separate physical barriers.
7. Evidence shall be provided to ascertain that gauges maintain acceptable levels of calibration. All gauges used on WisDOT projects shall have a documented three or five block calibration conducted by the manufacturer or calibration service within the last 12 months.
8. Storage of nuclear gauges shall meet both WisDOT and DHFS requirements.
9. All operators shall wear an appropriate personally issued Thermo Luminescent Dosimeter or Film Badge, or OSL badge per HFS 157.25(2)(a) 6.
10. All companies must have available an appropriate radiation survey meter in accordance with HFS 157.05(3).
11. Survey meter must be calibrated annually by a licensed calibration facility.
12. All accidents or incidents involving nuclear gauges shall be resolved in accordance with individual license requirements and/or with WisDOT and DH&FS policies and procedures.

13. Periodic review of nuclear density gauge operation and procedures will be conducted by WisDOT RSO, deficiencies will be discussed with the operator(s) and the operator(s) shall take corrective actions.
14. The duration of density tests shall be four (4) minutes for Troxler, CPN, Humboldt gauges and two (2) minutes in both the contact and the air gap position for Seaman gauges for quality assurance.










### **USE OF NUCLEAR GAUGES ON HMA**

1. It is highly recommended that moisture density gauge used on WisDOT projects be checked out on WisDOT calibration / reference check blocks to ascertain their calibration is within 1 pound per cubic foot of our block values. Or the contractor can use their own reference block if checked and approved by the department. Gauges shall be warmed up if required in the manufacturer's guidelines.
2. The region or contractor will establish a reference site approved by the department. Clearly marked out on a flat surface of concrete or asphalt or other material that will not be disturbed. Perform correlation monitoring with the QA, QV, and all back up gauges at the project reference site. The region may require a project reference site on projects.
3. Conduct an initial 10 density tests using the gauge on the project reference site, and calculate the average value to establish the reference value for each gauge. Use the gauge reference value as a control to monitor the calibration of the gauge for the duration of the project.
4. Check the gauge on the project reference site a minimum of 1 test per day if paving.
5. If a single gauge reading on the reference site deviates more than  $1.5 \text{ lb/ft}^3$  from the 10-test average for that gauge. The operator must investigate and conduct an additional 5 tests on the reference site. If the gauge does not fall within allowable tolerances contact WisDOT RSO and region contact person immediately.
6. On days that the QC, QA or QV tester is performing tests for the project he or she must take a new standard count on the material being tested.
7. During testing, the gauge shall always be set on a flat and level surface on the material being tested. A new standard must be taken on the grade before testing.
8. During tests, the following minimum distances of a gauge shall be maintained
  - a. Pavement construction joints > 20 feet
  - b. Operator > 3 feet
  - c. Bystanders > 15 feet
  - d. Equipment, manholes, etc. > 15 feet
  - e. Other nuclear devices > 30 feet
  - f. Unrestricted edge of pavement > 1.5 feet
  - g. Restricted edge of pavement > 1 foot

9. During testing, the gauge shall always be set on a flat surface, with the longest dimension of the gauge parallel to the edge of the pavement. Mark out gauge outline and show direction of source.
10. The duration of density tests shall be four (4) minutes for Troxler, CPN, Humboldt gauges and two (2) minutes in both the contact and the air gap position for Seaman gauges for quality assurance
11. Record on the pavement the lot number, test #, and the % compaction for all acceptance and verification tests.

#### Documentation:

The following data shall be recorded using WisDOT data work sheets.

-  Reference Site / Block Data (Daily Nuclear Calibration Check)
-  Standard Block Data – Density Standard, Moisture Standard
-  New Density & Moisture Standard Must Be Taken Every Day There Is Placement Of HMA Material That Requires Density Testing.
-  Density Count, Moisture Counts or Contact, Air Gap
-  Total / Wet Density or Bulk Density
-  % Compaction
-  Manufacture Name and Serial Number
-  Operators Name
-  Mix Design Number and Target Number (Gmm) X 62.24

#### **USE OF NUCLEAR GAUGES ON SOILS, BASE COURSES, ETC**












**It is highly recommended that moisture density gauge used on WisDOT projects be checked out on WisDOT calibration / reference check blocks to ascertain their calibration is within 1 pound per cubic foot of our block values. Or the contractor can use their own reference block if checked and approved by the department. Gauges shall be warmed up if required in the manufacturer's guidelines. The region or contractor will establish a project reference site approved by the department. Clearly marked out on a flat surface of concrete or asphalt or other material that will not be disturbed during the duration of the project. Perform correlation monitoring with the QC, QA, QV, and all back up gauges at the project reference site.**

2. Conduct an initial 10 density tests using a gauge on the project reference site and calculate the average value to establish a reference value. Use the reference value as a control to monitor the calibration of the gauge for the duration of the project.
3. Check the gauge on the project reference site a minimum of 1 test per day during placement of all material placed within the 1 to 1 slopes on project and compare to the reference value. Maintain the reference site test data for each gauge at an agreed location.

4. If a single gauge reading on the reference site deviates more than  $1.5 \text{ lb/ft}^3$  from the 10-test average for that gauge. The operator must investigate and conduct an additional 5 tests on the reference site. If the gauge does not fall within allowable tolerances contact WisDOT RSO and Region contact person immediately.
6. On days that the QC, QA or QV tester is performing tests for the project he or she must take a new standard count on the material being tested.
7. During tests, the following minimum distances of a gauge shall be maintained from:
  - a. Operator > 3 feet
  - b. Bystanders > 15 feet minimum
  - c. Equipment, manholes, etc. > 15 feet
  - d. Other nuclear gauges > 30 feet
8. The gauge shall be placed on a prepared surface with no more than  $1/16"$  void and only native material used as a filler.
12. Position the gauge handle to the appropriate test location either **BS, 2", 4", 6" or 8"** depths. Test shall not exceed the depth of the compacted layer.
10. After each test the operator must dig up the material below the gauge and check for voids, cobbles and or organics that could change test results.
11. The duration of density tests shall be four (4) minutes for Troxler, CPN, Humboldt and Seaman gauges with direct transmission. For Seaman gauges using backscatter the duration shall be (2) minutes in both the contact and the air gap position.
12. If the gauge needs to have a moisture bias for a specific soils the gauge operators needs to conduct 5 random test locations for that soils type. After each moisture/density gauge test has been completed the material directly below the gauge will be retained and a 1 point proctors shall be run at its natural moisture. Compare average natural moistures to the gauge moisture reading and if necessary compute moisture bias.
13. All proctor tests shall have a minimum of 4 or 5 points 2 ascending and 2 descending and 1 at or near the optimum the moisture curve.

#### Documentation:

The following data must be recorded on all WisDOT project data work sheets:

-  Reference Site / Block Data
-  Standard Block Data – Density Standard, Moisture Standard
-  Density Count, Moisture Counts or Contact, Air Gap
-  Total / Wet Density or Bulk Density
-  Dry Density or Bulk Density Dry
-  Moisture # and Moisture %
-  Proctor Number and Target Number
-  Pit Number, Grading area, Soils Classifications, Elevation
-  % Compaction
-  Manufacture Name and Serial Number
-  Operators Name